After becoming licensed and gaining experience, architects take on increasingly responsible duties, eventually managing entire projects. In large firms, architects may advance to supervisory or managerial positions. Some architects become partners in established firms; others set up their own practice.

Several States require continuing education to maintain a license, and many more States are expected to adopt mandatory continuing education. Requirements vary by State, but usually involve the completion of a certain number of credits every year or two through seminars, workshops, formal university classes, conferences, self-study courses, or other sources.

Job Outlook

Prospective architects may face competition for entry-level jobs, especially if the number of architectural degrees awarded remain at current levels or increases. Employment of architects is projected to grow about as fast as the average for all occupations through 2008 and additional job openings will stem from the need to replace architects who retire or leave the labor force for other reasons. However, many individuals are attracted to this occupation, and the number of applicants often exceeds the number of available jobs, especially in the most prestigious firms. Prospective architects who complete at least one summer internship—either paid or unpaid—while in school and who know CADD technology (especially that which conforms to the new national standards) will have a distinct advantage in obtaining an intern-architect position after graduation.

Employment of architects is strongly tied to the level of local construction, particularly nonresidential structures such as office buildings, shopping centers, schools, and healthcare facilities. After a boom in non-residential construction during the 1980s, building slowed significantly during the first half of the 1990s. Despite slower labor force growth and increases in telecommuting and flexiplace work, however, non-residential construction is expected to grow more quickly between 1998 and 2008 than during the previous decade, driving demand for more architects.

As the stock of buildings ages, demand for remodeling and repair work should grow considerably. The needed renovation and rehabilitation of old buildings, particularly in urban areas where space for new buildings is becoming limited, is expected to provide many job opportunities for architects. In addition, demographic trends and changes in health care delivery are influencing the demand for certain institutional structures, and should also provide more jobs for architects in the future. For example, increases in the school-age population have resulted in new school construction. Additions to existing schools (especially colleges and universities), as well as overall modernization, will continue to add to demand for architects through 2008. Growth is expected in the number of adult care centers, assisted-living facilities, and community health clinics, all of which are preferable, less costly alternatives to hospitals and nursing homes.

Because construction—particularly office and retail—is sensitive to cyclical changes in the economy, architects will face particularly strong competition for jobs or clients during recessions, and layoffs may occur. Those involved in the design of institutional buildings such as schools, hospitals, nursing homes, and correctional facilities, will be less affected by fluctuations in the economy.

Even in times of overall good job opportunities, however, there may be areas of the country with poor opportunities. Architects who are licensed to practice in one State must meet the licensing requirements of other States before practicing elsewhere. These requirements are becoming more standardized, however, facilitating movement to other States.

Earnings

Median annual earnings of architects were $47,710 in 1998. The middle 50 percent earned between $37,380 and $68,920. The lowest 10 percent earned less than $30,030 and the highest 10 percent earned more than $87,460.

According to the American Institute of Architects, the median compensation, including bonuses, for intern-architects in architectural firms was $35,200 in 1999. Licensed architects with 3 to 5 of years experience had median earnings of $41,100; licensed architects with 8 to 10 years of experience, but who were not managers or principals of a firm, earned $54,700. Principals or partners of firms had median earnings of $132,500 in 1999, although partners in some large practices earned considerably more. Similar to other industries, small architectural firms (fewer than 5 employees) are less likely than larger firms to provide employee benefits.

Earnings of partners in established architectural firms may fluctuate because of changing business conditions. Some architects may have difficulty establishing their own practices, and may go through a period when their expenses are greater than their income, requiring substantial financial resources.

Related Occupations

Architects design and construct buildings and related structures. Others who engage in similar work are landscape architects, building contractors, civil engineers, urban planners, interior designers, industrial designers, and graphic designers.

Sources of Additional Information

Information about education and careers in architecture can be obtained from:

☛ Careers in Architecture Program, The American Institute of Architects, 1735 New York Ave. NW., Washington, DC 20006.
Internet: **http://www.aiaonline.com**

Drafters

(O*NET 22514A, 22514B, 22514C, 22514D, and 22517)

Significant Points

- The type and quality of postsecondary drafting programs varies considerably; prospective students should be careful in selecting a program.
- Opportunities should be best for individuals who have at least 2 years of postsecondary training in drafting and considerable skill and experience using computer-aided drafting (CAD) systems.
- Demand for particular drafting specializations varies geographically, depending on the needs of local industry.

Nature of the Work

Drafters prepare technical drawings and plans used by production and construction workers to build everything from manufactured products such as spacecraft or industrial machinery to structures such as office buildings or oil and gas pipelines. Their drawings provide visual guidelines, showing the technical details of the products and structures, specifying dimensions, materials to be used, and procedures and processes to be followed. Drafters fill in technical details, using drawings, rough sketches, specifications, codes, and calculations previously made by engineers, surveyors, architects, or scientists. For example, they use their knowledge of standardized building techniques to draw in the details of a structure. Some drafters use their knowledge of engineering and manufacturing theory and standards to draw the parts of a machine in order to determine design elements such as the number and kind of fasteners needed to assemble it. They use technical handbooks, tables, calculators, and computers to do this.

Traditionally, drafters sat at drawing boards and used compasses, dividers, protractors, triangles, and other drafting devices to prepare a drawing manually. Most drafters now use computer-aided drafting (CAD) systems to prepare drawings. These systems employ computer work stations which create a drawing on a video screen. The drawings are stored electronically so that revisions or duplications can be made easily. These systems also permit drafters to easily and quickly prepare variations of a design. Although this equipment has become easier to operate, CAD is only a tool. Persons who produce technical drawings using CAD still function as a drafter, and need most of the knowledge of traditional drafters—relating to drafting skills and standards—as well as CAD skills.

As CAD technology advances and the cost of the systems continues to fall, it is likely that almost all drafters will use CAD systems regularly in the future. However, manual drafting may still be used in certain applications, especially in specialty firms that produce many one-of-a-kind drawings with little repetition.

Drafting work has many specializations and titles may denote a particular discipline of design or drafting. *Architectural drafters* draw architectural and structural features of buildings and other structures. They may specialize by the type of structure, such as residential or commercial, or by material used, such as reinforced concrete, masonry, steel, or timber.

Aeronautical drafters prepare engineering drawings detailing plans and specifications used for the manufacture of aircraft, missiles, and parts.

Electrical drafters prepare wiring and layout diagrams used by workers who erect, install, and repair electrical equipment and wiring in communication centers, powerplants, electrical distribution systems, and buildings.

Drafters use their knowledge of standardized building techniques to draw the details of a structure.

Electronic drafters draw wiring diagrams, circuit board assembly diagrams, schematics, and layout drawings used in the manufacture, installation, and repair of electronic devices and components.

Civil drafters prepare drawings and topographical and relief maps used in major construction or civil engineering projects such as highways, bridges, pipelines, flood control projects, and water and sewage systems.

Mechanical drafters prepare detail and assembly drawings of a wide variety of machinery and mechanical devices, indicating dimensions, fastening methods, and other requirements.

Process piping or *pipeline drafters* prepare drawings used for layout, construction, and operation of oil and gas fields, refineries, chemical plants, and process piping systems.

Working Conditions

Drafters usually work in comfortable offices furnished to accommodate their tasks. They may sit at adjustable drawing boards or drafting tables when doing manual drawings, although most drafters work at computer terminals much of the time. Because they spend long periods of time in front of computer terminals doing detailed work, drafters may be susceptible to eyestrain, back discomfort, and hand and wrist problems.

Employment

Drafters held about 283,000 jobs in 1998. Over 35 percent of all drafters worked in engineering and architectural services firms that design construction projects or do other engineering work on a contract basis for organizations in other industries. Another 29 percent worked in durable goods manufacturing industries, such as machinery, electrical equipment, and fabricated metals. The remainder were mostly employed in the construction, communications, utilities, and personnel supply services industries. About 17,600 were self-employed in 1998.

Training, Other Qualifications, and Advancement

Employers prefer applicants for drafting positions who have completed postsecondary school training in drafting, which is offered by technical institutes, community colleges, and some 4-year colleges and universities. Employers are most interested in applicants who have well-developed drafting and mechanical drawing skills; a knowledge of drafting standards, mathematics, science, and engineering technology; and a solid background in computer-aided drafting and design techniques. In addition, communication and problem-solving skills are important.

Individuals planning careers in drafting should take courses in math, science, computer technology, design or computer graphics, and any high school drafting courses available. Mechanical and visual aptitude are also important. Prospective drafters should be able to draw freehand, three-dimensional objects and do detailed work accurately and neatly. Artistic ability is helpful in some specialized fields, as is knowledge of manufacturing and construction methods. In addition, prospective drafters should have good interpersonal skills because they work closely with engineers, surveyors, architects, and other professionals.

Entry level or junior drafters usually do routine work under close supervision. After gaining experience, intermediate level drafters progress to more difficult work with less supervision. They may be required to exercise more judgment and perform calculations when preparing and modifying drawings. Drafters may eventually advance to senior drafter, designer, or supervisor. Many employers pay for continuing education, and with appropriate college degrees, drafters may go on to become engineering technicians, engineers, or architects.

Many types of publicly and privately operated schools provide some form of drafting training. The kind and quality of programs

vary considerably. Therefore, prospective students should be careful in selecting a program. They should contact prospective employers regarding their preferences and ask schools to provide information about the kinds of jobs obtained by graduates, type and condition of instructional facilities and equipment, and faculty qualifications.

Technical institutes offer intensive technical training but less of the general education than do junior and community colleges. Certificates or diplomas based on completion of a certain number of course hours may be rewarded. Many offer 2-year associate degree programs, which are similar to or part of the programs offered by community colleges or State university systems. Other technical institutes are run by private, often for-profit, organizations, sometimes called proprietary schools. Their programs vary considerably in both length and type of courses offered.

Community colleges offer curriculums similar to those in technical institutes but include more courses on theory and liberal arts. Often there is little or no difference between technical institute and community college programs. However, courses taken at community colleges are more likely to be accepted for credit at 4-year colleges than those at technical institutes. After completing a 2-year associate degree program, graduates may obtain jobs as drafters or continue their education in a related field at 4-year colleges. Four-year colleges usually do not offer drafting training, but college courses in engineering, architecture, and mathematics are useful for obtaining a job as a drafter.

Area vocational-technical schools are postsecondary public institutions that serve local students and emphasize training needed by local employers. Many offer introductory drafting instruction. Most require a high school diploma or its equivalent for admission.

Technical training obtained in the Armed Forces can also be applied in civilian drafting jobs. Some additional training may be necessary, depending on the technical area or military specialty.

The American Design Drafting Association (ADDA) has established a certification program for drafters. Although drafters are not usually required to be certified by employers, certification demonstrates that nationally recognized standards have been met. Individuals who wish to become certified must pass the Drafter Certification Test, which is administered periodically at ADDA-authorized test sites. Applicants are tested on their knowledge and understanding of basic drafting concepts such as geometric construction, working drawings, and architectural terms and standards.

Job Outlook

Employment of drafters is expected to grow more slowly than the average for all occupations through 2008. Although industrial growth and increasingly complex design problems associated with new products and manufacturing will increase the demand for drafting services, greater use of CAD equipment by architects and engineers, as well as drafters, should offset this growth in demand. Many job openings, however, are expected to arise as drafters move to other occupations or leave the labor force.

Opportunities should be best for individuals who have at least 2 years of postsecondary training in a drafting program that provides strong technical skills, and who have considerable skill and experience using CAD systems. CAD has increased the complexity of drafting applications while enhancing the productivity of drafters. It has also enhanced the nature of drafting by creating more possibilities for design and drafting. As technology continues to advance, employers will look for drafters having a strong background in fundamental drafting principles with a higher level of technical sophistication and an ability to apply this knowledge to a broader range of responsibilities.

Demand for particular drafting specializations varies throughout the country because employment is usually contingent upon the needs of local industry. Employment of drafters remains highly concentrated in industries that are sensitive to cyclical changes in the economy, such as engineering and architectural services and durable goods manufacturing. During recessions, drafters may be laid off. However, a growing number of drafters should continue to be employed on a temporary or contract basis, as more companies turn to the personnel supply services industry to meet their changing needs.

Earnings

Median hourly earnings of drafters were $15.56 in 1998. The middle 50 percent earned between $12.29 and $19.73. The lowest 10 percent earned less than $10.19 and the highest 10 percent earned more than $24.84. Median hourly earnings in the industries employing the largest numbers of drafters in 1997 are shown below:

Motor vehicles and equipment	$21.50
Personnel supply services	16.20
Miscellaneous business services	15.60
Fabricated structural metal products	14.30

Related Occupations

Other workers who prepare or analyze detailed drawings and make precise calculations and measurements include architects, landscape architects, designers, engineers, engineering technicians, science technicians, cartographers, and surveyors.

Sources of Additional Information

Information on schools offering programs in drafting and related fields is available from:

☛ Accrediting Commission of Career Schools and Colleges of Technology, 2101 Wilson Blvd., Suite 302, Arlington, VA 22201.

Information about certification is available from:

☛ American Design Drafting Association, P.O. Box 11937, Columbia, SC 29211. Internet: **http://www.adda.org**.

Landscape Architects

(O*NET 22308)

Significant Points

- Over 40 percent are self-employed—four times the proportion for all professionals.
- A bachelor's degree in landscape architecture is the minimum requirement for entry-level jobs; many employers prefer to hire landscape architects who have completed at least one internship.
- Because many landscape architects work for small firms or are self-employed, benefits tend to be less generous than those provided to workers in large organizations.

Nature of the Work

Everyone enjoys attractively designed residential areas, public parks and playgrounds, college campuses, shopping centers, golf courses, parkways, and industrial parks. Landscape architects design these areas so that they are not only functional but beautiful and compatible with the natural environment as well. They plan the location of buildings, roads, and walkways and the arrangement of flowers, shrubs, and trees. Historic preservation and natural resource conservation and reclamation are other important objectives to which landscape architects may apply their knowledge of the environment as well as their design and artistic talents.

Many types of organizations—from real estate development firms starting new projects to municipalities constructing airports or parks—hire landscape architects, who are often involved with the